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Ehret et al.

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(54) **VOLUMETRIC DISPLACEMENT DISPENSER**

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(63) Continuation-in-part of application No. 11/332,277, filed on Jan. 13, 2006, now abandoned.

(51) **Int. Cl.**
B67D 5/42 (2006.01)

(52) **U.S. Cl.** **222/386.5**; 222/387; 222/400.7; 222/478; 222/1; 215/231; 215/269; 215/307

(58) **Field of Classification Search** 222/386.5, 222/400.7, 92, 387, 389, 1, 105, 95, 478, 222/479, 481; 215/231, 269, 307; 220/720
See application file for complete search history.

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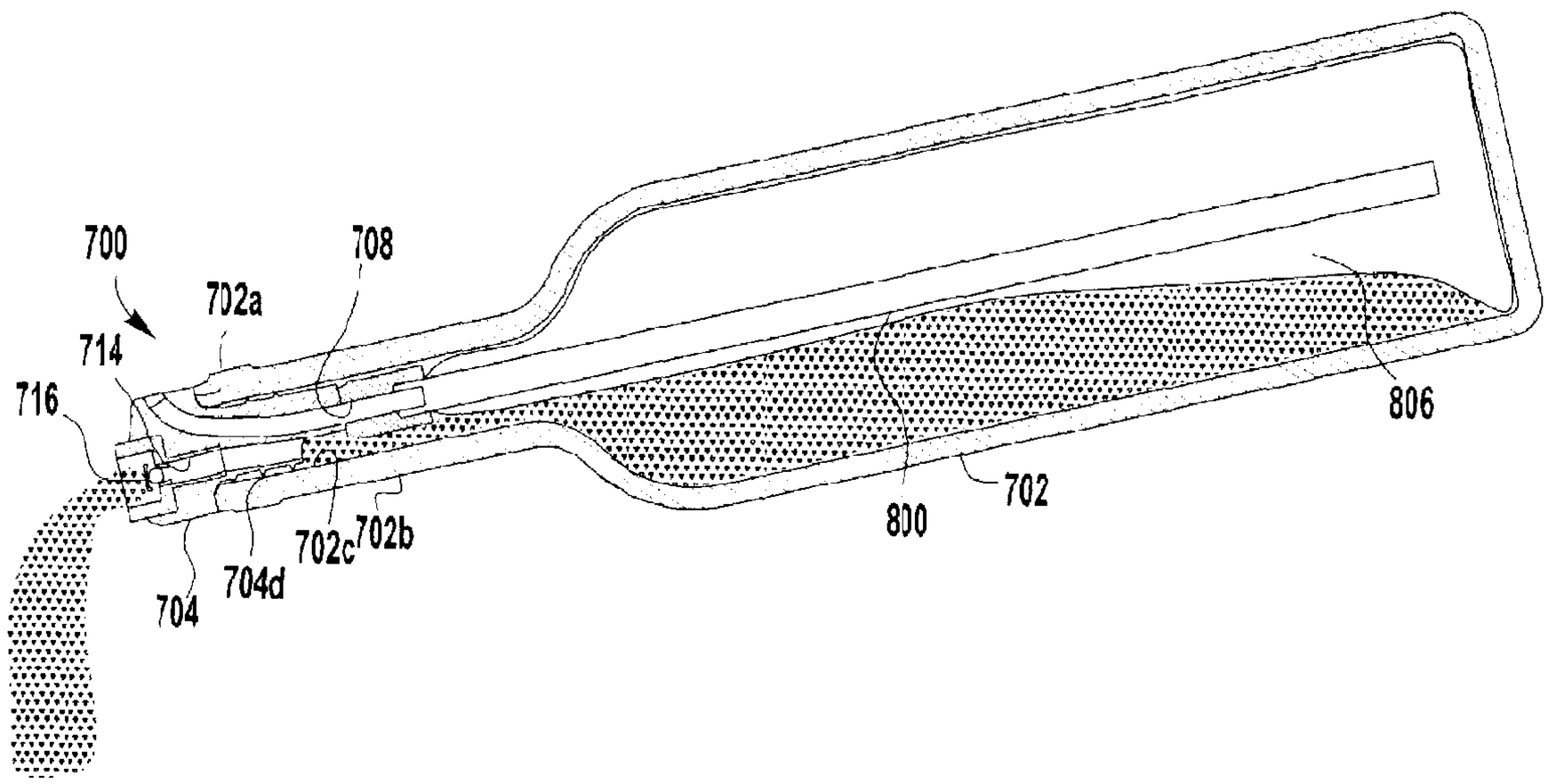
(57) **ABSTRACT**

A volumetric displacement dispenser and method of using the dispenser is disclosed for dispensing liquid contents from an interior of a bottle with a bottle neck while preventing air from filling a void created within the interior of the bottle caused by the liquid contents being poured out of the bottle by gravity. The dispenser includes a stopper having first and second boreholes extending there through, the stopper being adapted to form an air-tight seal when it is seated into the bottle neck. An air pressure tube routed through the first of the boreholes has a first end open to atmospheric air and a second end open to the interior of the bottle. An expandable volumetric displacement balloon is attached to the second end of the air pressure tube and a one-way liquid valve is disposed in the outlet of the liquid flow channel in the stopper.

7 Claims, 5 Drawing Sheets



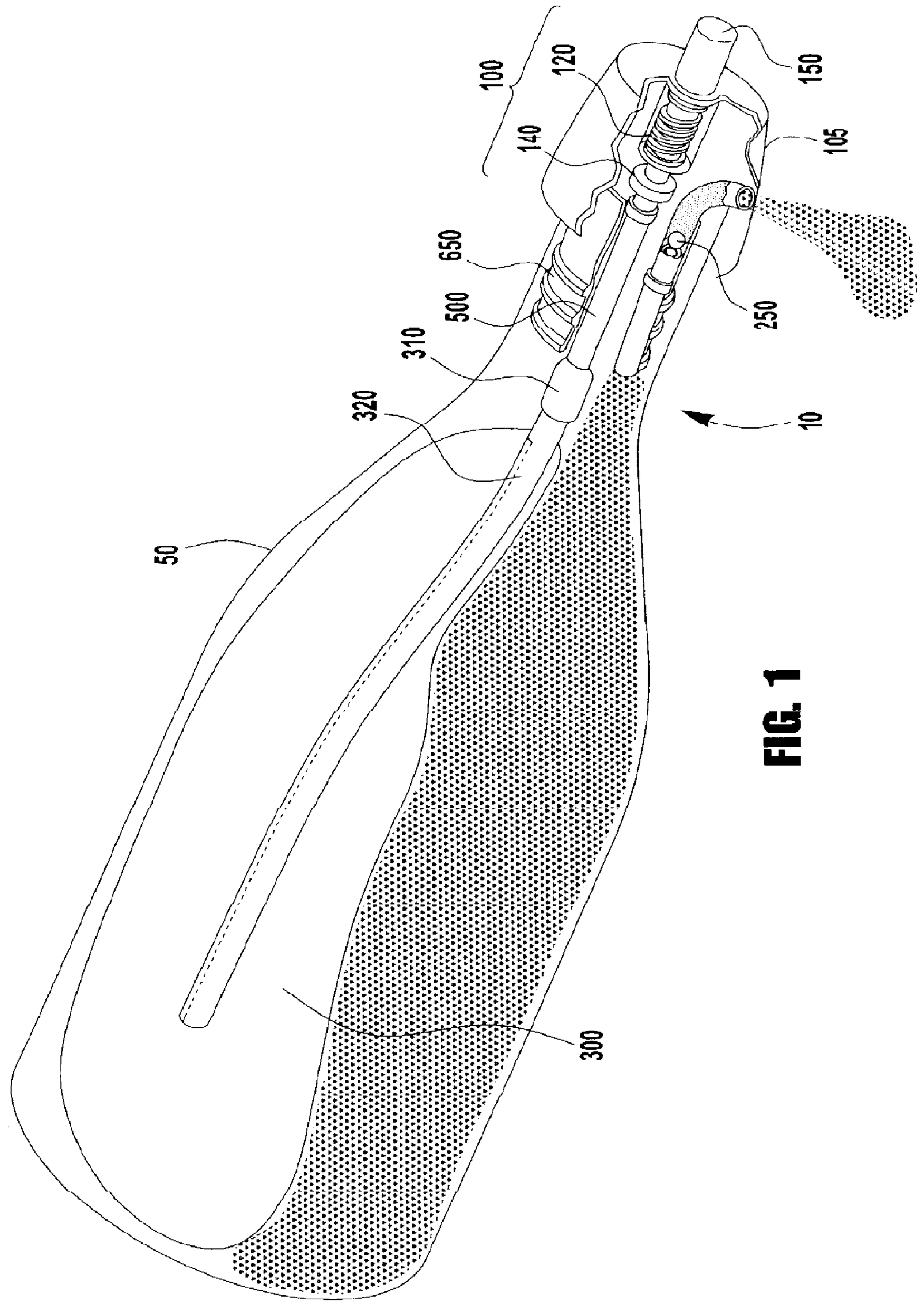
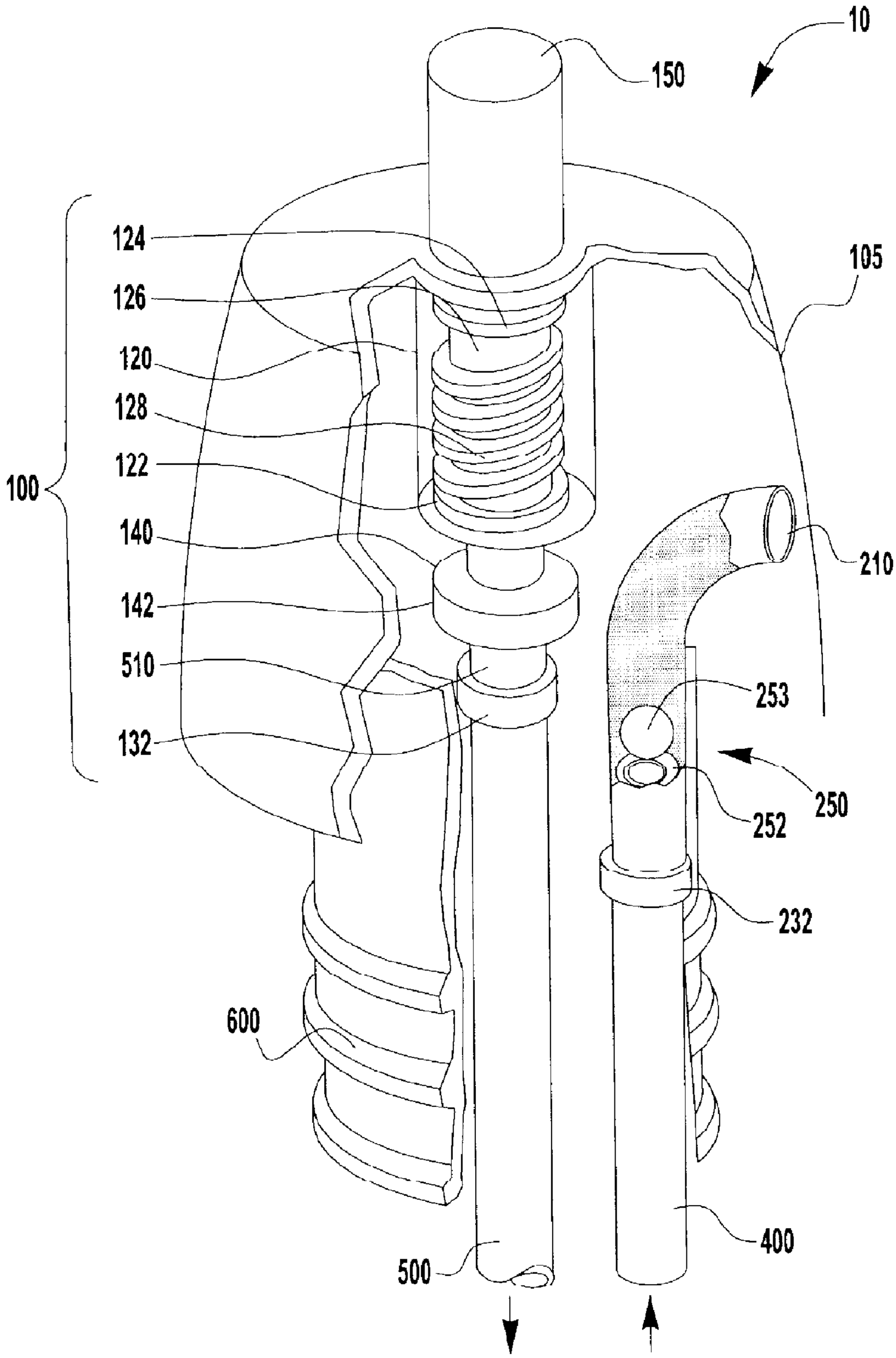


FIG. 1


10
150
124
126
120
128
122
100
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142
510
132
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210
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232
600
500
400

FIG. 2A

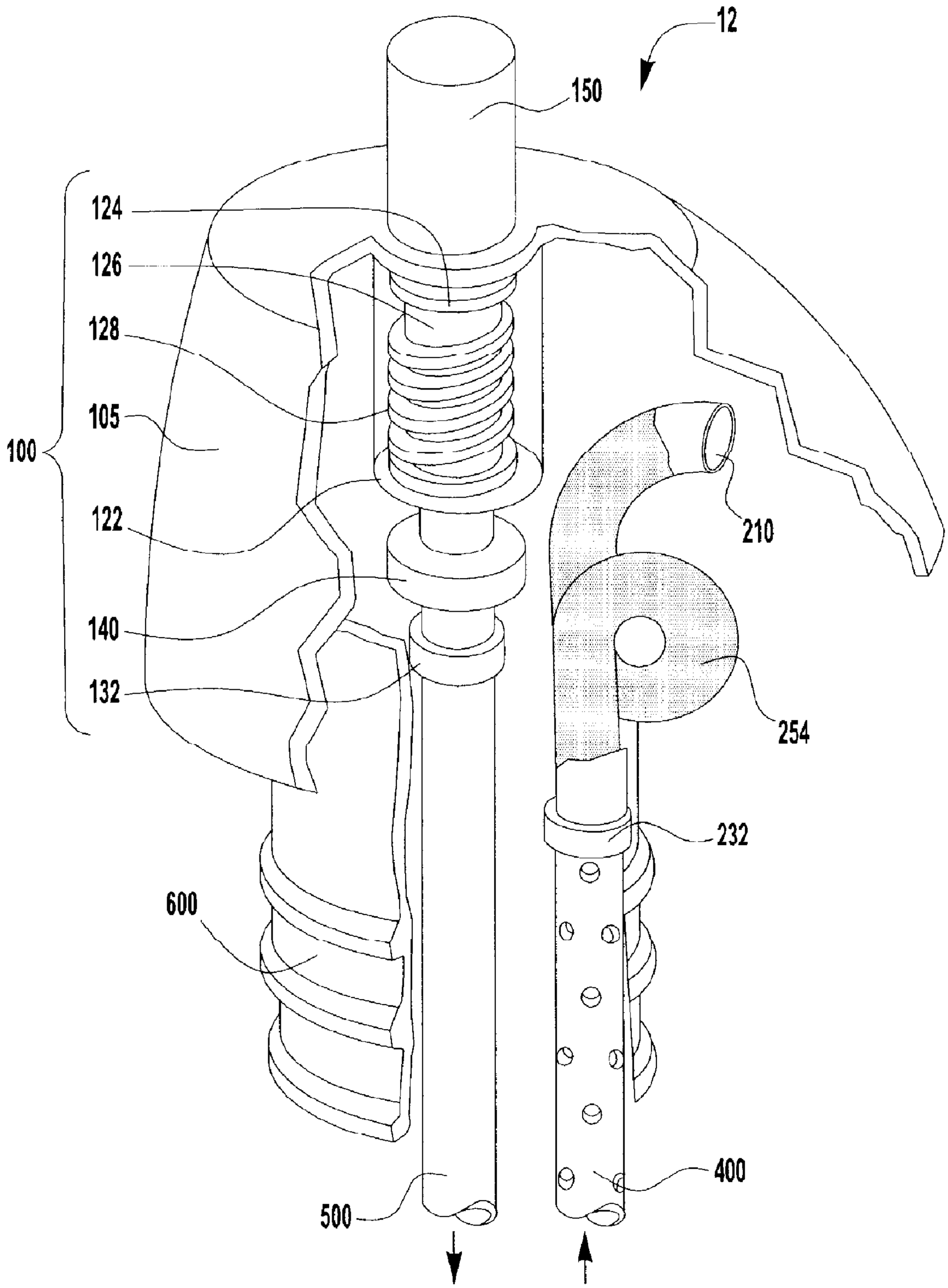

FIG. 2B

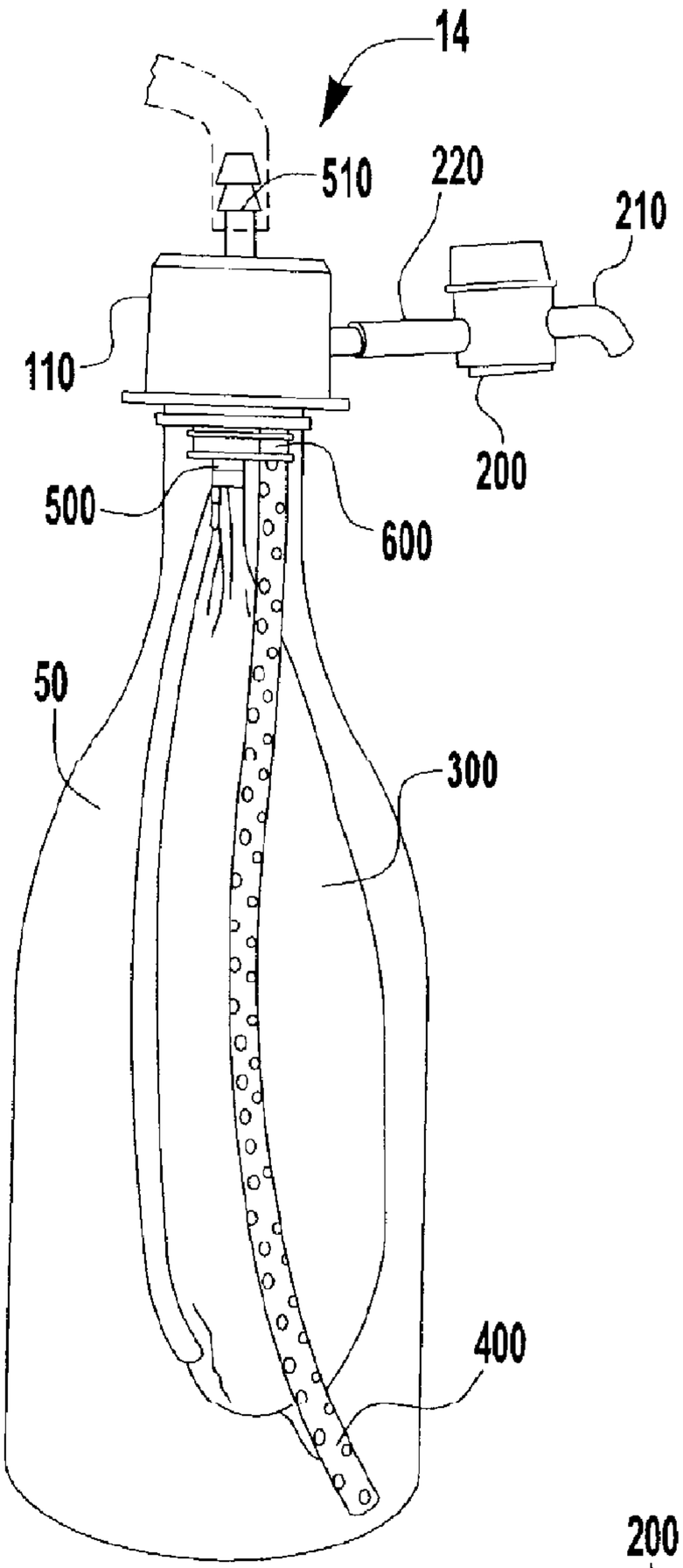

FIG. 3

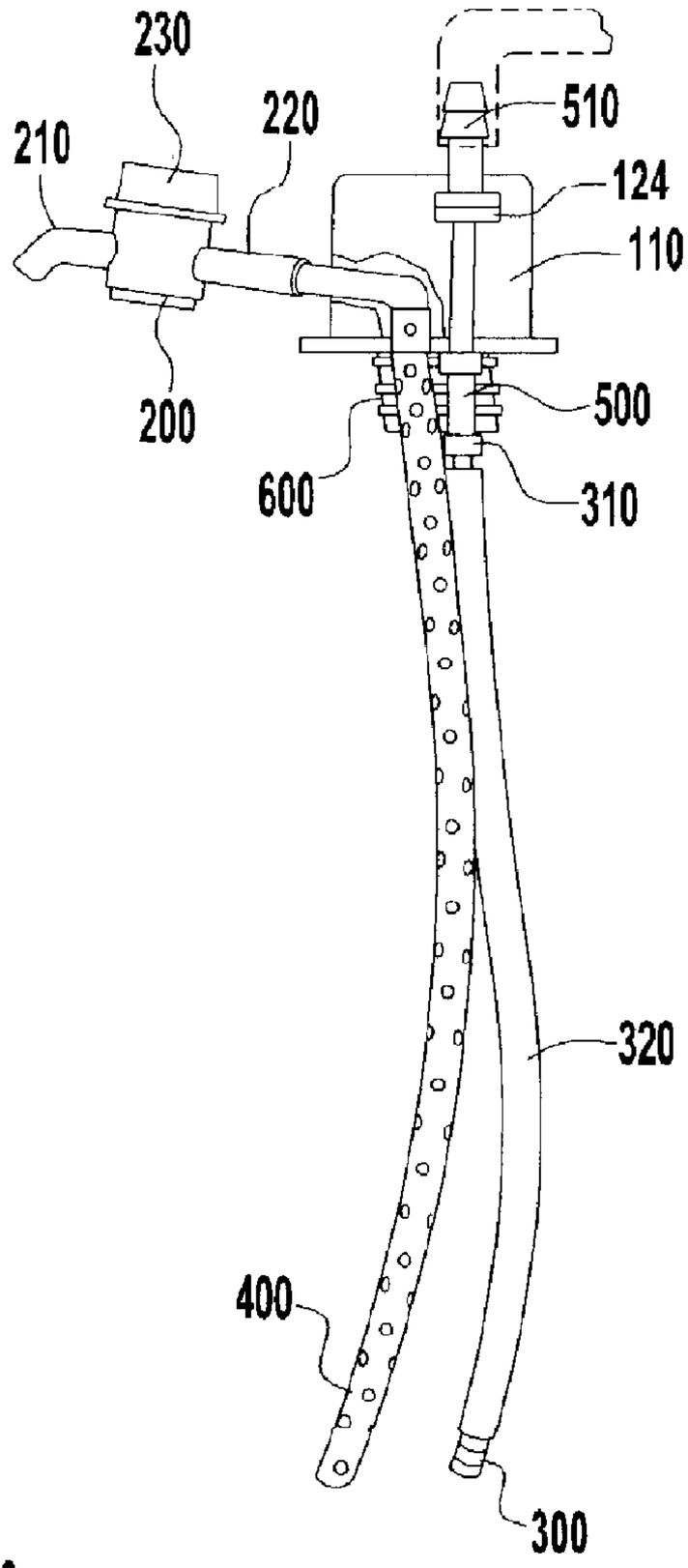

FIG. 5

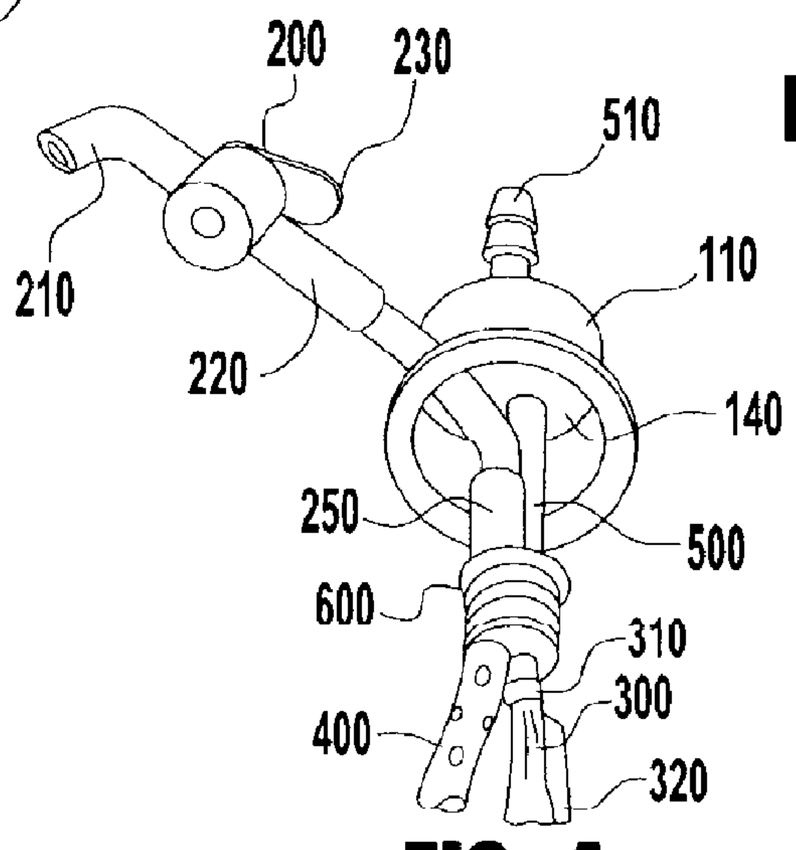

FIG. 4

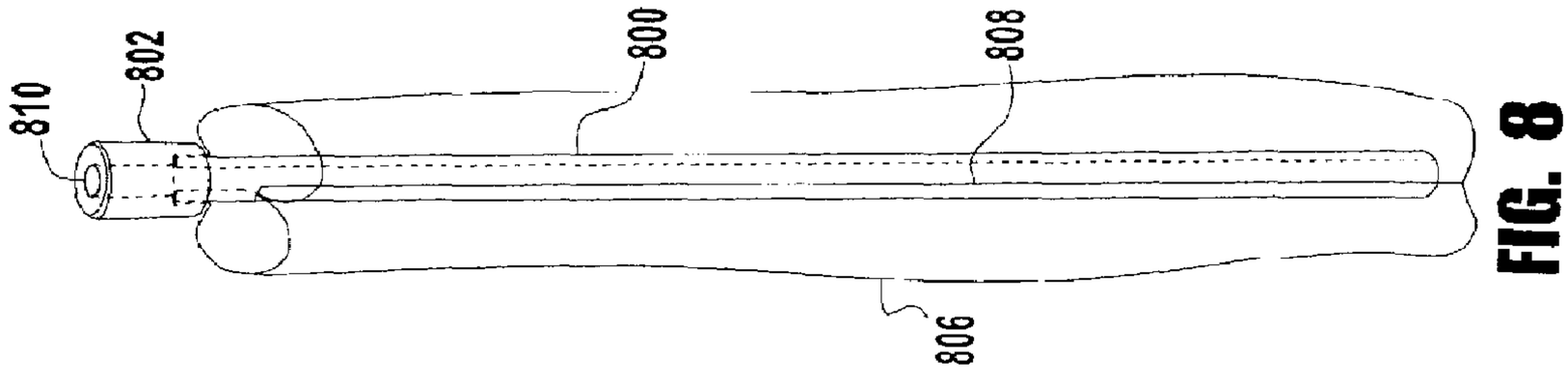

FIG. 8

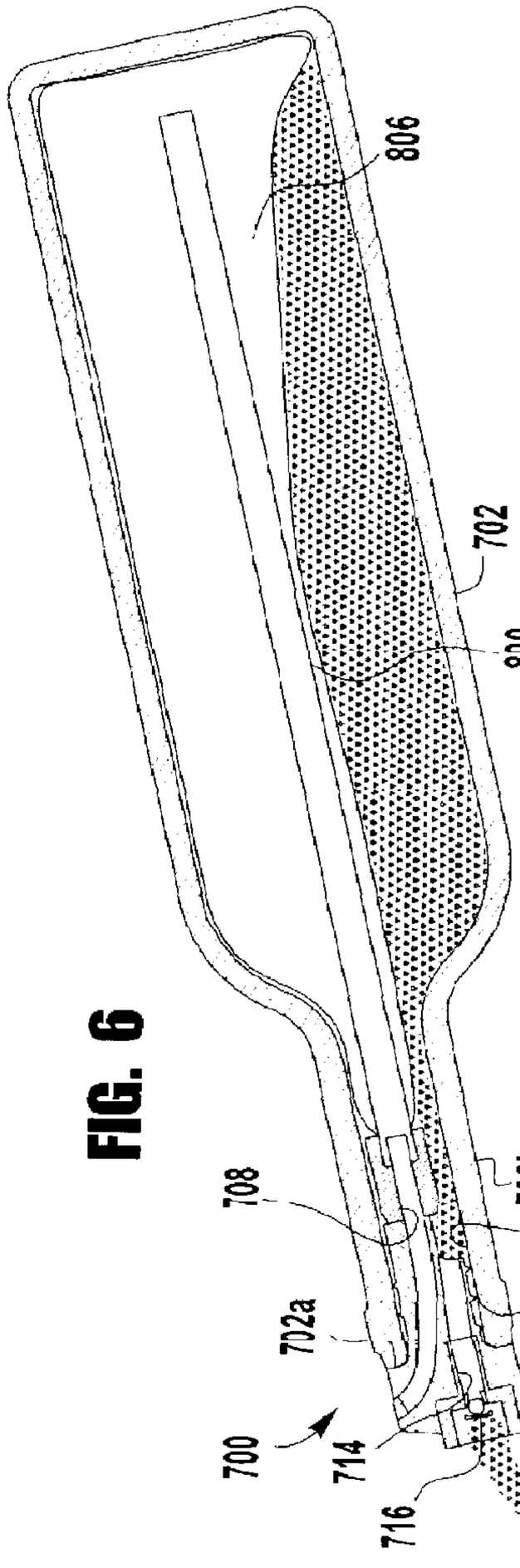

FIG. 6

FIG. 7

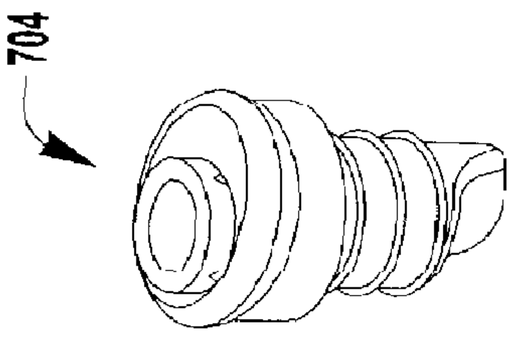

FIG. 9

VOLUMETRIC DISPLACEMENT DISPENSER

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation in part of U.S. application Ser. No. 11/332,277 entitled VOLUMETRIC DISPLACEMENT DISPENSER, and filed on Jan. 13, 2006, now abandoned which in turn claims the benefit of U.S. Provisional Patent Application Ser. No. 60/647,610, filed on Jan. 27, 2005.

FIELD OF THE INVENTION

The present invention specifically relates to a volumetric displacement dispenser to provide the individual user the capability of dispensing a given quantity of dispensable liquids or other beverages, such as wines or other perishable commodities, from a container and allowing the storage of the beverage over an extended period of time through the exclusion of air from the container; thus reducing degradation of the container contents whereby the desirable characteristics of the beverage are preserved in their original state. In one embodiment, the volumetric displacement dispenser comprises an air pump, check valves and an expandable polymer operative balloon of sufficient gauge and material whereby the balloon expands easily to fill a void occasioned by removal of wine from the wine container. The air pump in cooperation with the check valves operates to expand the operative balloon to dispense wine from the container by pressure of the expanded operative balloon. In another, more simplified embodiment, the volumetric displacement dispenser includes an inlet port connected to an expandable polymer balloon whereby the balloon expands easily to fill a void occasioned by removal of wine from the wine container. An outlet port in the volumetric displacement dispenser provides for removal of the wine from the container.

DESCRIPTION OF THE RELATED ART

An effective means for preserving wines and other beverages, once they have been initially decanted, has long been a problematic issue that has confronted the consumer of these commodities. Due to the broad spectrum of liquid commodities negatively impacted by prolonged exposure to air, the discussion of the related art centers about the preservation of wine.

Wine has long been recognized as a valued commodity that has transcended ancient times to present. Due to the chemical composition of wine, it is especially susceptible to degradation via oxidation processes that pose the risk of spoiling the flavor and bouquet in the short term and converting it to a less desirable product, i.e., vinegar, in the long term. Through the ages, there have been various attempts to develop an acceptable solution to this dilemma, wherein the preservation of foodstuffs was essential to trade and commerce, and daily aspects of life in ancient civilization. This point was further exacerbated given the fact that few control means existed to mitigate the degradation of wine from the extremes of environment. The most popular means of preserving wines was by limiting exposure to air (corking) and the addition of stones or oil and storing the wine in a cool area where exposure to sunlight was limited. In each of these methods, the container contained excess air and did not preserve the quality of the wine. Moreover, diffusion of air through the cork plays a role in the aging of the wine. A balance is required between amount of air required in the aging process and excess air

beyond that required in aging. Advances, such as using wax to prevent entrance of air through the voids of the cork, improved the sealing properties of corking. However, without removal of air in the void space above the wine's surface, the wine was still subject to degradation. Stones or oil were introduced into the container to displace the air by displacement of the void volume. But each volume displacement method introduced new contaminants, (dirt, oil, bacteria, etc.) to the wine, which impaired the quality of the stored wine. Also, volume replacement by stones, glass or other solid media increased weight of the container, creating transportation problems. This method moreover served to negatively impact taste and body of the wine as bacteria and contaminants, which reacted with the wine, were introduced to the wine by the volume replacement objects. The use of oil as a volume replacement means served only slightly better as increased difficulty in decanting the wine had to be addressed. The need to completely extract the contents of the container required specialized extraction means as siphoning or use of unique containers to prevent the oil from being decanted with the wine. Another problem was that trace amounts of the oil were incorporated into the wine causing an oily taste and sometimes affecting the bouquet. The use of oils having relatively high paraffin contents and waxes solved some of the issues of separation. But, issues with decanting and contaminants still persisted.

A search for practical means of solving these issues has spawned a number of approaches. Some solutions relied on void volume reduction or sealing technology and means for introducing an inert gas to displace the air in the void space and removal of air by creating a vacuum.

Systems that use an inert gas are represented by Ellis, U.S. Pat. No. 4,984,711 ('711) wherein the wine dispenser utilizes a piercing means blanketed by an inert gas to avoid introduction of oxygen; thus, preserving the wine in its original state. This approach is both expensive and cumbersome to use, as the individual user expends additional effort in installing the dispenser on an uncorked bottle of wine. The installation is performed under pressure of the inert gas to prevent entrance of air. This can be a potential risk for the individual user, as the cork may be suddenly expelled and the contents discharged. It is noted that the Ellis '711 invention is limited to corked bottles and teaches no preservation technique for previously uncorked wines.

Sitton, U.S. Pat. No. 4,856,680 ('680), discloses preservation of a dispensed wine product by introducing the wine bottle and the remaining contents into a scaled container, wherein an inert gas such as nitrogen at a pressure exceeding 20 psig is introduced to purge the oxygen from the container. The container is then refrigerated and the contents of the bottle are withdrawn under pressure. This affords the user the possibility of preserving the wine for up to four to six weeks and preventing further aging of the wine. The Sitton '680 patent teaches use of a sealed container for the wine container and inert gas. This system though effective does not readily lend itself to those occasions when a consumer entertains a small party and it would be desirable to decant the wine by hand from the container.

Another popular methodology that has been employed has been the use of the beverage in a bag. U.S. Pat. No. 3,365,202 teaches application of pressure to a flexible bag containing a liquid to dispense the liquid contained therein. Although this patent teaches decanting the liquid within the bag through a decrease in volume obtained through external force, this patent does not address the problem of air entrance into the previously decanted liquid container.

Several patents attempt to solve this problem by inserting an inert gas through the cork stopper and extracting the wine without removing the cork. U.S. Pat. No. 3,883,043 to Lane and U.S. Pat. No. 4,011,971 to Haydon disclose devices utilizing a hollow needle inserted through the bottle cork to withdraw the wine and to introduce an inert gas into the void space above the wine. However, the insertion of the hollow needle through the bottle cork can introduce air into the void space above the wine level and cause deterioration of the contained wine. Also, as Sutton '680 teaches, as most beverages and wines are stored in glass containers, the amount of pressure that can be applied to the container is limited.

Another attempt at preservation extensively employed by many consumers of wines has been the use of devices to draw the air out of a bottle subsequent to re-corking the bottle. However, the success of this system has been variable, as a number of physical parameters limit the effectiveness of this technique. These parameters are the ability to induce a sufficient vacuum to reduce the volume of air in the bottle, the ability to maintain a vacuum once achieved and the ability to indicate when the required vacuum has been obtained. As these devices rely on the penetration of the stopper, even given the compressive qualities of corks, rubber and other materials used as stoppers, it is difficult to maintain a required vacuum for any length of time. Further, since wines are slowly aged in their bottles through the diffusion of oxygen through corks, changing the parameters of the cork would tend to shift the diffusion dynamics toward oxidation of the wine. Another shortcoming of this approach is the failure to foresee the trend of winemakers away from cork and toward plastic lined metal screw caps, which will not work with these systems.

Given the shortcomings and disadvantages of existing approaches to preserving wines and other dispensable liquids impacted by the effects of oxygen, an affordable and convenient means is desirable to preserve the quality of once-opened containers of wine from the harmful effects of ambient atmosphere.

ASPECTS AND SUMMARY OF THE INVENTION

It is accordingly an aspect of this invention to provide an invented device and method that provides a means to preserve the quality and bouquet of a wine and prevent further aging of the wine by minimizing introduction of air into the wine container and causing an occupation of the void space within the container by an expandable displacement dispenser that serves to protect the contained wine from contact with the ambient atmosphere.

It is accordingly another aspect of this invention to provide a wine preservation and dispensing system for bottled wine to allow wine to be dispensed from the bottle by the glass while protecting the wine in the bottle from the harmful effects of being exposed to the ambient air.

It is therefore a further aspect of this invention to provide a bottle cap assembly comprising (a) an air pump or a source of compressed gas, (b) air and liquid check valves, (c) an operative expandable polymer balloon, (d) a liquid discharge tube, (e) a casing for the operative expandable polymer balloon, and (f) a separate cap for the bottle cap assembly, associated tubing, retaining clips and connectors which, in combination, operate as a volumetric displacement dispenser of wine from a bottled container of wine.

It is yet another aspect of this invention to provide a dispenser for wine bottles, which provides a volumetric displacement balloon of sufficient flexibility to occupy the void space within a wine container caused by removal of decanted wine, which balloon is caused to expand by suction from the removal of wine from the container and the atmosphere air pressure which enters into the balloon through the bottle cap assembly.

It is another object of this invention to provide an alternative source of compressed gas versus an air pump to cause the operative balloon to expand to occupy the void space in a wine container between the liquid and the container.

It is still another aspect of this invention to provide a method for insertion of the volumetric displacement dispenser into a wine bottle while protecting contents of the bottle from ambient air.

Accordingly, the present invention relates to several devices and methods for dispensing a beverage from a bottle container and preventing harmful effects of air upon the contents of the bottle. The devices are specifically termed a volumetric displacement dispenser. The volumetric displacement dispensers are utilized in lieu of a cork or other closure for a container so as to preserve dispensable liquids, wines or other perishable commodities, wherein the liquids have a prolonged shelf life as the deleterious effects of oxygen are mitigated. The use of one embodiment of the volumetric displacement dispenser, comprising check valves, loop seals and an expanding operative balloon, allows the individual user to readily dispense the liquid contained within the container without need to recork, purging the container of air, or evacuating the atmospheric contents of the container as a function of dispensing the liquid. Recognizing the need for convenience and ease of use, the volumetric displacement dispenser operative balloon operates at atmospheric pressure. The check valves and loop seal permit liquids or gases to flow only in one direction and thus prevent loss of pressure on liquids or gases. Only a minimum of applied pump pressure is applied to insure that the volumetric displacement dispenser operative balloon obtains initial contact with the surface of the fluid therein. This serves to purge a small volume of the dispensable liquid to insure a liquid full system. Thereafter, whenever the liquid dispensing valve is opened and the fluid is decanted, atmospheric air is drawn into the volumetric displacement operative balloon by extraction of wine from the container. The volumetric displacement operative balloon is sufficiently flexible to occupy the void caused by the removal of the decanted wine. As air fills the volumetric displacement operative balloon, the space within the container is filled and entrance of oxygen restricted. Transparent tubing in the cap assembly can provide visual confirmation to the user that the system is liquid full.

According to the present invention, a volumetric displacement dispenser for dispensing liquid contents from a bottle with a bottle neck while preventing air from filling a void in the bottle caused by the removal of the liquid contents of the bottle, comprises: a stopper having first and second tube boreholes extending there through, the stopper being adapted to be seated into the bottle neck; an air/gas pressure tube routed through the first of the tube boreholes; an air pump/air vent assembly disposed in the air/gas pressure tube having an air/gas check valve inserted therein, the air pump/air vent assembly being open to atmospheric air; a liquid discharge tube routed through the second of the tube boreholes, the liquid discharge tube having a liquid control device incorporated therein; and an expandable volumetric displacement balloon attached to a first end of the air/gas pressure tube, the volumetric displacement balloon being expanded by air pressure from the from the air pump/air vent assembly. The liquid control device can be a check valve disposed in the liquid discharge tube.

Further according to the present invention, there is an elongated casing secured at one end to encase the expandable balloon. The elongated casing is attached to the first end of the air/gas pressure tube.

Still further according to the present invention, the volumetric displacement dispenser includes a source of compressed gas connected to a second end of the air/gas pressure tube, the source of compressed gas comprises a manually operated air pump or an external source of compressed gas.

Yet further according to the present invention, there is a dispensing liquid outlet attached an end of the liquid discharge tube and a liquid dispensing valve disposed between the end of the liquid discharge tube and the liquid discharge tube.

According to the present invention, a method for dispensing liquid contents of a bottle with a bottle neck while preventing air from filling a void in the bottle caused by the removal of the liquid contents of the bottle, comprises the following steps: a stopper having first and second tube boreholes extending there through is seated into the bottle neck of a bottle containing a liquid; compressed air is applied through an air pump/air vent assembly open to atmospheric air and having an air/gas check valve, and then into an air/gas pressure tube routed through the first of the tube boreholes into an expandable volumetric displacement balloon connected to the air/gas pressure tube whereby the balloon is inflated so that a small amount of the liquid is dispensed from the bottle through a dispensing liquid outlet attached to an end of a liquid discharge tube routed through the second of the tube boreholes; the liquid from the bottle is dispensed through the dispensing liquid outlet whereby atmospheric air from the air pump/air vent assembly flows into the volumetric displacement balloon and causes the balloon to expand and fill the void in the bottle corresponding to the volume of liquid dispensed from the bottle

Further according to the present invention, the method comprises the step of encasing the expandable balloon in an elongated casing attached to the second end of the air/gas pressure tube to enable the expandable balloon to be inserted through the bottle neck into the bottle.

Still further according to the present invention, the method includes the step of using a manually operated air pump to cause compressed air to flow through the air/gas check valve. Alternatively, an external source of compressed gas can cause compressed air to flow through the air/gas check valve.

According to the present invention, a volumetric displacement dispenser for dispensing liquid contents from an interior of a bottle with a bottle neck while preventing air from filling a void created within the interior of the bottle caused by the liquid contents being poured out of the bottle by gravity comprises: a stopper having first and second boreholes extending there through, the stopper being adapted to form an air-tight seal when it is seated into the bottle neck; an air pressure tube routed through the first of the boreholes, the pressure tube having a first end open to atmospheric air, and a second end open to the interior of the bottle; an expandable volumetric displacement balloon attached to the second end of the air pressure tube; and a one-way liquid valve disposed in the outlet of the liquid flow channel in the stopper.

Further according to the present invention, the air pressure tube is unobstructed to allow atmospheric air from outside the bottle to flow directly into the expandable volumetric displacement balloon and the second end of the air pressure tube extends into the interior of the bottle. Moreover, an elongated casing is disposed within the expandable balloon. The elongated casing is attached to the second end of the air pressure tube so that the expandable balloon can be inserted into the bottle when the stopper is seated into the bottle neck. The elongated casing has a slot extending along its length to and into which the expandable balloon is tucked into the casing after being folded so that the balloon can expand out into the interior of the bottle when atmospheric air is drawn through the air pressure tube into the balloon.

Still further according to the present invention, a pouring spout is fitted within the second borehole with an opening there through forming a flow channel for pouring out the liquid from within the bottle. The pouring spout is connected to the outlet of the liquid one-way valve.

According to the present invention, a method for dispensing liquid contents of a bottle with a bottle neck while preventing air from filling a void in the bottle caused by the removal of the liquid contents of the bottle comprises: seating a stopper having first and second tube boreholes extending there through into the bottle neck to form an airtight seal with the bottle neck; routing an unobstructed air pressure tube through the first of the tube boreholes, the pressure tube having a first end open to atmospheric air, and a second end in communication with the open end of a volumetric displacement balloon disposed within the bottle; dispensing the liquid from the bottle through the second borehole while atmospheric air is simultaneously drawn through the unobstructed air pressure tube directly into the volumetric displacement balloon whereby the displacement balloon expands and fills the void in the bottle corresponding to the volume of liquid dispensed from the bottle.

Further according to the present invention, the method comprises the step of providing a liquid one-way valve in the second borehole to allow liquid within the bottle to pour flow out of the bottle via the liquid one-way valve while substantially preventing atmospheric air from entering the bottle through the second borehole.

Still further according to the present invention, the method further comprises the step of encasing an elongated casing attached to the second end of the air pressure tube with the expandable balloon to enable the expandable balloon to be inserted through the bottle neck into the bottle. The elongated casing is provided with a slot extending along its length into which the expandable balloon is tucked into the casing after being folded to allow the expandable balloon to expand out into the interior of the bottle when atmospheric air is drawn through the air pressure tube into the balloon.

Other objects, features and advantages of the invention will become apparent in light of the following description thereof.

BRIEF DESCRIPTIONS OF THE DRAWINGS

The structure, operation, and advantages of the present invention will become further apparent upon consideration of the following description taken in conjunction with the accompanying figures (FIGS.). The figures are intended to be illustrative, not limiting.

Certain elements in some of the figures may be omitted, or illustrated not-to-scale, for illustrative clarity. The cross-sectional views may be in the form of "slices", or "near-sighted" cross-sectional views, omitting certain background lines which would otherwise be visible in a "true" cross-sectional view, for illustrative clarity.

In the drawings accompanying the description that follows, often both reference numerals and legends (labels, text descriptions) may be used to identify elements. If legends are provided, they are intended merely as an aid to the reader, and should not in any way be interpreted as limiting.

Often, similar elements may be referred to by similar numbers in various figures (FIGS.) of the drawing, in which case

typically the last two significant digits may be the same, the most significant digit being the number of the drawing figure (FIG).

FIG. **1** illustrates an embodiment of the invention wherein an air pump is affixed to an air inlet in the cap assembly to pump air into the volume displacement dispenser operative balloon and an air/gas check valve is operable in the air/gas pressure tube to the operative balloon and a check valve is operable in the liquid discharge tube.

FIG. **2**A illustrates the details of the embodiment of FIG. **1**.

FIG. **2**B illustrates an alternative embodiment of the invention of FIG. **1** wherein the liquid discharge tube uses a loop seal in place of a check valve.

FIG. **3** illustrates an alternative embodiment of the instant invention wherein an external source of a compressed gas is applied to pressure the operative balloon to expand.

FIG. **4** illustrates the details of the embodiment of the cap of FIG. **3**.

FIG. **5** illustrates the further details of the embodiment of FIG. **3**.

FIG. **6** is a cross sectional view of an alternative embodiment of a volumetric displacement dispenser according to the present invention wherein the air inlet is free of check valves and sources of compressed gas to provide unimpeded air flow from the atmosphere to cause an operative balloon to expand.

FIG. **7** is a cross sectional view illustrating the details of the volumetric displacement dispenser shown in FIG. **6**.

FIG. **8** is an isometric view of a casing for a volumetric displacement device adapted to be connected to the volumetric displacement dispenser as shown in FIG. **6**.

FIG. **9** is an isometric view of the volumetric displacement dispenser as shown in FIG. **7**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. **1-5**, the Figures illustrate several embodiments of the volumetric displacement dispenser device comprising a flexible inflatable operative balloon and means permitting liquids and gases to flow only in one direction.

Referring to FIGS. **1** and **2**A, volumetric displacement dispenser **10** is illustrated as inserted in a bottle **50** by ported stopper **600** wherein components of said dispenser **10** comprise a cap assembly **100**. Cap assembly **100** comprises cap-air pump **105** with one aperture on the top surface for air pump piston shaft **150** and further comprises air pump/air vent assembly **120** connected to air/gas pressure tube **500** with air/gas check valve **140** inserted therein. Cap assembly **100** further comprises a liquid discharge tube **400** wherein liquid check valve **250** is inserted therein. Volumetric displacement device casing **320** is retained by retaining clip **310** on air/gas pressure tube **500**. Volumetric displacement operative balloon **300** is also connected to air/gas pressure tube **500** by retaining clip **310**. Air pump piston shaft **150** comprising an air pump means is positioned on piston **126** of air pump/air vent assembly **120** to pump air into volumetric displacement operative balloon **300** as required.

Referring to FIG. **2**A, the details of the embodiment of cap assembly **100** of the volumetric displacement dispenser **10** of FIG. **1** are illustrated. Air pump/air vent body **122** contains air pump piston shaft **150** positioned on air pump/air vent assembly **120**, which comprises piston **126** and piston spring **128**. Air/gas check valve **140** containing air check valve flapper **142** (not shown) is interposed between air pump/air vent assembly **120** and air/gas pressure tube **500** to prevent backflow and to control air injected into volumetric displacement device operative balloon by operation of air pump/air vent assembly **120**. Retainer **124** seats air pump piston shaft **150** on air pump/air vent assembly **120**. Inlet air connector **132** secures pressure tube inlet **510** to air/gas pressure tube **500**. Liquid discharge tube **400** is preferably of a length shorter than the air/gas pressure tube **500**. It is, however, within the terms of the invention to provide the liquid discharge tube **400** with perforations as shown in FIGS. **3-5**. The liquid discharge tube **400** and air/gas pressure tube **500** are inserted through fitted bores in ported stopper **600**. Discharge tube connector **232** secures liquid discharge tube **400** to liquid check valve **250** comprising liquid check valve seat **252**, a ball check valve **253** and liquid spigot **210**. Note that the liquid spigot **210** at the end of discharge tube **400**, as shown in FIGS. **1** and **2**A, is disposed at 90° or less with the elongated discharge tube.

FIG. **2**B illustrates an alternative embodiment of the volumetric displacement dispenser **10** of FIGS. **1** and **2**A. In FIG. **2**B, volumetric displacement dispenser **12** incorporates a loop seal **254** at the outlet end of liquid discharge tube **400** instead of liquid check valve **250** and liquid check valve seat **252** as in FIG. **2**A. All other details of the volumetric displacement dispenser **12** are the same as the volumetric displacement dispenser **10** as illustrated in FIGS. **1** and **2**A.

FIGS. **3-5** illustrate another alternative embodiment of a volumetric displacement dispenser. In FIG. **3**, a volumetric displacement dispenser **14** is inserted in bottle **50** by ported stopper **600**. An external inert gas supply (not shown) under pressure supplies pressurized gas to volumetric displacement operative balloon **300** through pressure tube inlet **510** and retainer **124** to volumetric displacement operative balloon **300**. Volumetric displacement operative balloon **300** is attached to air/gas pressure tube **500** by retaining clip **310** (See FIG. **5**), which also retains volumetric displacement device casing **320** which encompasses operative balloon **300** to facilitate insertion of operative balloon **300** into bottle **50**. Cap—external gas **110** of the alternative embodiment has two apertures, one on the top surface for pressure tube inlet **510** and one on the side surface for dispensing liquid outlet **220**. Liquid outlet **220** dispenses liquid through liquid spigot **210** attached thereto by operating dispensing valve operator **230** of liquid dispensing valve **200**. Preferably, the liquid outlet **220** is constructed of a clear material such that a user can check the bottle is full of liquid at all time.

The expandable operative balloon **300** is essential for application of any of the volumetric displacement dispenser devices of the present invention. As an operative element of the volumetric displacement dispenser device, the expandable volumetric displacement operative balloon **300** is essential for the physical operation of the volumetric displacement dispenser device and performs the necessary operation for the volumetric displacement dispenser device to fill the void occasioned by removal of wine from the wine container **50**. The expansion of the volumetric displacement operative balloon **300** under pressure also operates to pressurize the dispensing of wine from the container **50**. As shown in FIG. **1**, balloon fills the void caused by the removal of the wine from the bottle. Essentially, there is a pressure void created in the bottle as the wine is dispensed which causes air to automatically be drawn into the balloon through the air pump/air vent assembly **120**.

Air/gas check valve **140**, liquid check valve **250** and/or loop seal **254** in liquid discharge tube **400** are essential for operation of the volumetric displacement operative balloon **300**. As operative elements, the check valve **250** and the loop seal **254** are essential for the physical operation of the volumetric displacement operative balloon **300** by controlling and preventing backflow of gases and liquids to control flow of the respective gases and liquids.

Further referring to FIGS. **1-5**, the figures illustrate preferred embodiments of a volumetric displacement dispenser in accordance with the present invention.

Referring to FIG. **1**, the bottle **50** is shown in a position where the contents, typically wine, are being poured out from the discharge tube **400**. Note that the operative balloon **300** fills the empty portion of the bottle **50** as the contents are poured out. In effect, the balloon **300** floats on the liquid contents keeps the flow path to the discharge tube **400** free. The balloon **300** is initially is filled partially with pressurized gas using the air pump **105**. Once the balloon **300** is partially expanded and the wine flows from the bottle, the balloon continues to expand as the negative pressure in the bottle causes atmospheric air to enter the balloon from the air pump/air vent assembly **120**.

Referring to FIGS. **1-5**, three embodiments of a volumetric displacement dispenser are generally shown at **10**, **12** and **14**. In FIGS. **1** and **2**B, volumetric displacement dispenser **10** comprises cap **105** of cap assembly **100** and a check valve **250** for a first embodiment. In FIG. **2**B, volumetric displacement dispenser **12** comprises cap **105** of cap assembly **100** and a loop seal valve **254** for a second embodiment. In FIGS. **3-5**, an alternative cap-external gas **110** is provide for third embodiment.

The cap assembly **100** (FIG. **1**) of the first embodiment further comprises air pump/air vent assembly **120** connected to air pump/air vent body **122** (FIG. **2**A) of pressure tube inlet **510**, which is subsequently routed through a fitted bore in ported stopper **600** by air/gas pressure tube **500** and connected to volumetric displacement device operative balloon **300** (FIG. **1**) by upper retaining clip **310** (FIG. **1**). Retaining clip **310** also retains volumetric displacement device casing **320** in position encompassing operative balloon **300**.

The second embodiment shown in FIG. **2**B is essentially identical with the first embodiment of FIGS. **1** and **2**A except the check valve **250** of the first embodiment is replaced with the loop seal valve **254**.

The cap-external gas **110** of an alternative embodiment shown in FIGS. **3-5**, comprises pressure tube inlet **510**, a liquid dispensing valve **200**, a dispensing valve operator **230** (FIGS. **4-5**), liquid spigot **210** (FIGS. **3-5**) and dispensing liquid outlet **220** (FIGS. **3-5**) connected to liquid discharge tube **400**, which is subsequently routed through a fitted bore in ported stopper **600** (FIGS. **3-5**) wherein liquid discharge tube **400** (FIG. **3**) extends into the bottle **50** in contact with the vessel's contents.

In operation, any of the volumetric displacement dispensers **10**, **12** or **11** are placed into a bottle **50**. The ported stopper **600** (FIGS. **1-5**) is securely seated to provide an air tight and air-pressure tight seal within the neck of the bottle **50**, wherein cap assembly **100** and cap with cap **105** and cap-external gas **10** cover the outer surface of the neck of the bottle **50**.

The volumetric displacement dispensers **10**, **12** or **14** may be inserted into any vessel or container, irrespective of the configuration wherein evacuation of air or maintenance of an inert environment is desirable for the preservation of the fluids contained therein. In preferred embodiments, cap assembly **100** with cap **105** and cap-external gas **110** may have an outer flexible sealing ring (not shown) about the base of cap assembly **100** with cap **105** and cap-external gas **110** to engage the outer surface of the neck of the bottle **50** thereby forming a seal to prevent contaminants from entering the bottle **50** or the internals of cap assembly **100** with cap **105** and cap-external gas **110**. The outer sealing ring may be comprised of any polymeric, elastomer material including but not limited to rubber, plastic, copolymer compounds or cork. In another embodiment, the outer sealing ring may be an integral element of the cap assembly.

The volumetric displacement dispensers **10**, **12** and **14** construction material can be selected from a group consisting of polymers, polymer alloys, non-ferrous metals, ferrous metals, carbon fiber, carbon powder, silicone polymers, elastomers, glass, ceramics and combinations thereof. The tubing can be transparent to allow visual confirmation of the operation of the device. When indicated, use of the volumetric displacement dispenser **10**, **12** or **14** is for food or sanitary usage, compliance with U.S. Department of Agriculture (USDA) or U.S. Food and Drug Administration (FDA) regulations regarding the selected materials of construction is necessary. The volumetric displacement dispensers may be manufactured by any technique recognized in the Mechanical Arts but not limited to molding, casting, forging, sintering, spinning, polishing, plating and any combinations thereof which are capable of yielding a finished product satisfying regulatory guidelines governing the use of such products, i.e. FDA, USDA, etc.

In a first embodiment of FIG. **2**A, the user applies a pressure source of compressed air by operation of air pump piston shaft **150** and air pump/air vent assembly **120** to air/gas check valve **140**. Compressed air flows through air check valve flapper **142** to pressure tube inlet **510**, to air/gas pressure tube **500** and into volumetric displacement operative balloon **300**. Liquid check valve **250** prevents backflow of gases. The initial application of air pressure to operative balloon **300** will cause flow of wine from liquid spigot **210**. That is, the manual pump **150** is intended to initially purge any remaining air in the bottle after the volumetric displacement dispensers **10** has been inserted into the bottle. The purging of the air is affected by the initial pressurizing of the volumetric displacement operative balloon **300** which initially causes any air trapped in the bottle to flow from the liquid spigot. Once the wine begins to flow from the spigot, any air trapped in the bottle is essentially removed.

In an alternate embodiment of FIG. **1** (see FIG. **2**B), liquid spigot **210** is connected to vertical loop seal **254** wherein the loop seal comprises at least one 360° loop of tubing for 360° vertical circular flow. Loop seal **254** acts to control outflow of liquid spigot **210** and acts to prevent backflow of gases into the container/vessel.

In another embodiment (FIGS. **3-5**), the user applies a pressure source of an external compressed inert gas that is greater than the atmospheric pressure to the pressure tube inlet **510** using a coupling connector (not shown), which protrudes vertically from top surface of cap-external gas **110**. Pressure tube inlet **510** is retained in position as cap-external gas **110** by retainer **124**. The compressed gas flows through air/gas check valve **140** to air/gas pressure tube **500** into volumetric displacement operative balloon **300**. Concurrently, the user opens liquid dispensing valve **200** on the dispensing liquid outlet **220** to liquid spigot **210**.

In the embodiment (FIGS. **3-5**), a liquid may be employed in lieu of a gaseous pressure source. This allows the air or other gases in the bottle **50** to be purged through perforated tube **400** while the volumetric displacement operative balloon **300** inflates by the liquid pressure and occupies the void space in the bottle **50** thus forcing the liquid up perforated tube **400** through liquid check valve **250** and out liquid spigot **210**, until the user closes the liquid dispensing valve **200** (FIGS. **3-5**). When the user decants the contained liquid, dispensing valve **200** is opened causing the internal and external pressure to equilibrate.

In the first embodiment, upon drawing fluid from the bottle **50**, suction force is applied to the surface of the volumetric

displacement operative balloon **300** in contact with the liquid resulting in balloon inflation by drawing in atmospheric air through the air pump/air vent assembly **120**. The suction force on the volumetric displacement operative balloon **300** is transmitted to the air/gas check valve **140** by pressure tube inlet **510** to air pump/air vent assembly **120**. Air/gas check valve **140** is drawn open by the negative suction force wherein air is admitted in a volume directly corresponding to the volume of liquid decanted. This process is repeated by the user until the volume of liquid in the bottle **50** is decanted. In another embodiment (not shown), air/gas check valve **140** may comprise a mechanism for temperature compensation, wherein the spring tension of the valve closure may respond to colder temperatures by reducing the spring tension, and conversely by increasing the spring tension upon exposure to increases in temperature.

In the embodiment shown in FIGS. **3-5**, application of additional measured amounts of compressed gas results in added decantation of wine from the container by inflation of the operative balloon.

Further, referring to FIGS. **1-5**, additional details of the volumetric displacement dispenser are generally shown. Referring to cap-air pump **105** of cap assembly **100** (FIGS. **1**, **2**A-**2**B) and cap-external gas **110** (FIGS. **3-5**) each have a given shape, height, circumference, a top, a base, a contiguous circumferential side, an inside surface and an outside surface. Air pump/air vent assembly **120** is connected to cap-air pump **105** of cap assembly **100** underside by retainer **124** (FIGS. **2**A-**2**B). Air pump/air vent body **122** (FIG. **2**A) has an inlet (not shown). Retainer **124** (FIGS. **2**A-**2**B, **5**), is in communication with air/gas check valve **140** (FIGS. **2**A, **2**B, **4**) wherein air/gas check valve **140** is disposed to operation by the user and is connected to pressure tube inlet **510** (FIG. **2**A); and air/gas pressure tube **500** (FIGS. **1-5**), subsequently terminating in volumetric displacement operative balloon **300**. The volumetric displacement operative balloon **300** with capacity to yield to a minimum suction force or vacuum has resistance to tearing and rupture in event of over-pressurization, moderate impulse forces or cyclic forces. The pressure tube inlet **510** is connected to air/gas pressure tube **500** by inlet air connector **132** (FIG. **1**). The volumetric displacement operative balloon **300** is connected to air/gas pressure tube **500** by retaining clip **310**. Both air/gas pressure tube **500** and liquid discharge tube **400** are routed through ported stopper **600** with each tube borehole in substantial agreement with the outside diameter of each tube. Thereby, a pressure and watertight seal is facilitated to provide isolation of the contents of the bottle **50** or other similar container from the environment.

In alternative embodiments of cap assembly **100** and cap-external gas **110** (FIGS. **2**A-**2**B, **3-5**), air/gas check valve **140** can comprise a connection means such as but not limited to a nipple, union, hose barb, solder joint, coupling and any other fitting known in the Mechanical Arts to permit a number of volumetric displacement dispensers' inlets to be connected to a manifold. Compressed air or an inert gas can be supplied as required through the manifold to inflate the volumetric displacement operative balloon **300** (FIG. **3**). This alternative embodiment requires that the manifold (not shown) has at least one demand valve having an adjustable set pressure range for predetermined pressure.

Referring to FIGS. **1** and **3**, the volumetric displacement operative balloon is shown as **300**. The volumetric displacement operative balloon **300** comprises a flexible membrane of a given shape, length and diameter, having a first end, a second end and having at least one opening in the first end, which is responsive to a suction force or vacuum at minimal increments developed by a suction force or vacuum from removal of fluid, wherein a corresponding enlargement of the membrane occurs. The volumetric displacement operative balloon **300** may comprise a membrane having a configuration in substantial agreement with the container in which the volumetric displacement dispenser **10** is utilized such that the entire volume of the container is occupied by the volumetric displacement operative balloon **300** upon inflation.

The volumetric displacement operative balloon **300** membrane typically is of varying gauge corresponding to the length and symmetry of the container/vessel. Upon inflation, the volumetric displacement operative balloon **300** expands. As stated earlier, the volumetric displacement operative balloon **300** comprises materials of construction required by the U.S. Food and Drug Administration for food grade polymers and elastomers, and must not evidence wear or deterioration from contact with the fluid or the container/vessel.

Specifically, referring to FIG. **2**A, illustrating a first embodiment, cap-air pump **105** of cap assembly **100** is shown in accordance with the present invention. Cap-air pump **105** encloses air pump/air vent assembly **120**, air pump/air vent body **122**, retainer **124**, liquid spigot **210** and ported stopper **600**.

Air pump/air vent assembly **120** (FIG. **2**A) comprises air pump/air vent body **122** with an air inlet (not shown) in the topside of cap-air pump **105**. Retainer **124** secures the air pump/air vent assembly **120** to cap-air pump **105** while simultaneously serving as a guide for piston **126** in the bore of air pump/air vent body **122**. Piston **126** is maintained in spaced agreement with the internal walls of air pump/air vent body **122**. The downward axial travel of piston **126** is opposed by piston spring **128**, having a spring constant and force in direct contact with the piston **126**.

In operation, a method of use of the instant invention is detailed for the user to employ the following sequence to replace an existing container stopper with the volumetric displacement dispenser **10** (FIGS. **1-5**) in the following procedure:

(a) Remove the original container seal.

(b) Determine if volumetric displacement operative balloon **300**, casing **320** and liquid discharge tube **400** can be inserted into the container opening and if cap assembly **100** will seal the container opening.

(c) Insert volumetric displacement operative balloon **300** and liquid discharge tube **400** into the container, taking care not to disconnect pressure tube inlet **510** and air/gas pressure tube **500** from inlet air connector **132** and discharge tube connector **232**.

(d) Insert cap assembly **100** into the container opening until the cap assembly base is firmly seated against the top of the container opening.

(e) Insure that cap assembly **100** fits tightly into the container.

(f) Inflate the volumetric displacement operative balloon **300** until a small volume of the dispensable liquid is decanted. Transparent tubing in cap assembly **100** can provide visual confirmation that the system is liquid full.

(g) Close liquid dispensing valve **200** if applicable.

(h) In the event that the volumetric displacement operative balloon **300** loses contact with the dispensable liquid, the sequence is repeated.

Open liquid dispensing valve **200** and withdraw liquid from the container. The user should observe that the volumetric displacement operative balloon **300** expands, maintaining contact with the dispensable liquid.

A table of reference characters used for parts of the volumetric displacement dispenser follows.

TABLE OF REFERENCE CHARACTERS FOR PARTS OF THE VOLUMETRIC DISPLACEMENT DISPENSER

Reference Character	Part Term
10	VOLUMETRIC DISPLACEMENT DISPENSER
50	BOTTLE
100	CAP ASSEMBLY
105	CAP-AIR PUMP
110	CAP-EXTERNAL GAS
120	AIR PUMP/AIR VENT ASSEMBLY
122	AIR PUMP/AIR VENT BODY
124	RETAINER
126	PISTON
128	PISTON SPRING
132	INLET AIR CONNECTOR
140	AIR/GAS CHECK VALVE
142	AIR/GAS CHECK VALVE FLAPPER
150	AIR PUMP PISTON SHAFT
200	LIQUID DISPENSING VALVE
210	LIQUID SPIGOT
220	DISPENSING LIQUID OUTLET
230	DISPENSING VALVE OPERATOR
232	DISCHARGE TUBE CONNECTOR
250	LIQUID CHECK VALVE
252	LIQUID CHECK VALVE SEAT
254	LOOP SEAL
300	VOLUMETRIC DISPLACEMENT OPERATIVE BALLOON
310	RETAINING CLIP
320	VOLUMETRIC DISPLACEMENT DEVICE CASING
400	LIQUID DISCHARGE TUBE
500	AIR/GAS PRESSURE TUBE
510	PRESSURE TUBE INLET
600	PORTED STOPPER

In summary, the instant invention comprises a volumetric displacement dispenser for bottles for dispensing measured quantities with exclusion of air from contents of the dispensing bottle, the liquid dispenser embodied as a bottle cap assembly wherein said bottle cap assembly, as a volumetric displacement dispenser, in combination, comprises: (a) a separate cap for said bottle cap assembly, (b) a means for a source of compressed gas, (c) an air/gas check valve, (d) a liquid control means, (e) an expandable operative polymer balloon, (f) a casing of polymer material to encase said expandable operative polymer balloon, (g) a ported stopper to seat said bottle cap assembly in neck of dispensing bottle, and (h) associated polymer tubes, retaining clips and tubing connectors.

The means for a source of compressed gas can comprise a manually operated air pump, which comprises a piston shaft, a piston, a piston spring, a retainer for the air pump/air vent body, an air pump/air vent body assembly and an air pump/air vent body.

The means for a source of compressed gas can comprise an external source of compressed gas for attachment to an external pressure tube inlet by coupling connector inserted through said separate cap for said bottle cap assembly and held in place by a retainer. The source of compressed gas can comprise a source of an inert gas comprising a cylinder of compressed gas.

The air/gas check valve comprises an air/gas check valve flapper positioned in the air/gas pressure tube.

The liquid control means comprises: (a) a liquid check valve seat, (b) a liquid check valve, (c) a perforated liquid discharge tube, (d) a liquid dispensing valve, (e) dispensing valve operator, (f) a dispensing liquid outlet, and (g) a liquid spigot.

The liquid control means comprises (a) a perforated liquid discharge tube and (b) a vertical loop seal in said liquid discharge tube wherein said vertical loop seal consists of at least one 360° loop of tubing for at least one 360° circular loop of vertical liquid flow.

The ported stopper has fitted bores, which route tubes through said stopper and said stopper is sized to securely seat within neck of the dispensing bottle.

A method of use of the instant invention to replace an existing container stopper with the volumetric displacement dispenser with exclusion of air from contents of the dispensing bottle comprises the following procedure:

(a) Remove the original container seal.

(b) Determine if the operative balloon encased in the balloon casing and liquid discharge tube is insertable into the container opening and if the dispenser portal stopper seals the container opening.

(c) Insert the operative balloon encased in the balloon casing and liquid discharge tube into the container opening, taking care not to disconnect the pressure tube inlet and air/gas pressure tube from the inlet air connector and discharge tube connector.

(d) Insert the cap assembly into the container opening until the cap assembly ported stopper is firmly sealed in the container opening.

(e) Insure cap assembly fits tightly in the container.

(f) Inflate the operative balloon until a small volume of liquid from the container is decanted and the operative balloon contacts the surface of the dispensable fluid.

(g) In the event the operative balloon loses contact with the contained fluid, the sequence is repeated.

ADDITIONAL EMBODIMENT

Referring to FIGS. **6** and **7**, an alternative embodiment of a volumetric displacement dispenser **700** is illustrated. In FIG. **6**, the volumetric displacement dispenser **700** is shown inserted in a bottle **702**. The dispenser **700** includes the ported stopper **704** as best seen in FIGS. **7** and **9**. The ported stopper **704** has a generally, cylindrical head portion **704***a* with a bottom surface **704***b* that is engageable over the mouth **702***a* of the bottle neck **702***b*. The ported stopper **704** also has a generally, cylindrically shaped stem portion **704***c* integrally connected and extending from the bottom surface **704***b* of head portion **704***a*. The cylindrically shaped stem portion **704***c* has a ridge **704***d* that spirals around and projects from the cylindrically shaped stem portion **704***c* to engage the internal surface **702***c* of the bottle neck **702***b*. The ridge **704***d* is an important aspect of the present invention in that it insures that the ported stopper **704** forms an airtight seal with the bottle neck **702***b*. While ridge **704***d* is shown, it is within the terms of the present invention to insure that an airtight seal is formed by any means such as a simple force fit of the stopper into the bottle neck **702***b*. The cylindrically shaped stem portion **704***c* also has a first portion **704***h* which extends to a bottom end **704***f* and a second portion **704***i* that is slightly more than half the length of the stem portion **704***c* and extends to a bottom end **704**. The spacing between the bottom ends **704***f* and **704***j* allows for easier flow of the liquid contents from the bottle **702** when the expandable balloon **806** expands, as discussed in more detail below.

As shown in FIG. **7**, a first tube borehole **706** extends through the ported stopper **704** from the side surface **704***e* of the cylindrical head portion **704***a* to the bottom end **704***f* of the cylindrically shaped stem portion **704***c*. Within the first tube borehole **706**, there is disposed an air pressure tube **708** routed there through so that a first open end **708***a* is slightly

recessed from the side surface **704***e* and is open to atmospheric air when the stopper **704** is seated in the bottle neck **702***b*. A second open end **708***a* of air pressure tube **708** extends outward from bottom end **704***f* a distance whereby the elongated sleeve **802** at one end of the elongated casing **800**, as shown in FIG. **8** and discussed in detail hereinafter, can be mounted onto the air pressure tube so that an end of the sleeve is disposed against the bottom end **704***f* of the cylindrically shaped stem portion **704***c*. The air pressure tube **708** provides an unobstructed path for atmospheric air to flow directly into the expandable balloon.

Referring again to FIG. **7**, a second borehole **710** extends through the ported stopper **704** from the upper surface **704***g* of the cylindrical head portion **704***a* to the bottom end **704***j* of the cylindrically shaped stem portion **704***c*. The second borehole **710** has a first section **710***a* that is open at the bottom end **704***j* end and is within cylindrical head portion **704***a*. The section **710***a* connects to a second section **710***b* that has a slightly larger diameter than section **710***a*. A third section **710***c*, joined to second section **710***b*, opens to the upper surface **704***g* of the head portion **704***a* and is effectively a counter bore.

A pouring spout **712** is fitted within the second borehole **710**. The pouring spout **712** has a lower section **712***a* that is fitted into second section **710***b* and an upper section **712***b* that is fitted into the third section **710***c* of the borehole **710** and projects outward from the upper surface **704***g* of the head portion **704***a*. The pouring spout **712** has an inner passageway **714** extending there through to provide a path there through to decant the liquid within the bottle to which the stopper **704** is disposed. Within the inner passageway **714** through the pouring spout **712** is a one-way valve **716** which normally closes the passageway through the pouring spout except when the liquid contents are being poured out. The one way valve **716** provides an important function of the invention. That is, it prevents atmospheric air from entering the bottle whenever the liquid contents are not being poured out through the pouring spout **712**. Never the less, the specific type of one-way valve is not important to the present invention.

Referring to FIG. **8**, there is shown an elongated casing **800** to house the expandable volumetric displacement balloon **806**. The balloon **806** has the casing **800** disposed within the balloon so that the open end **806***a* of the balloon is wrapped around one end **800***a* of the elongated casing **800**. An elongated sleeve **802**, mounted to one end **800***a* of the casing **800**, secures the open end of the balloon **806** to the end of the casing so that the bore **810** through the sleeve is open to the open end **806***a* of the balloon. Typically, the end of the open end of balloon **806** is folded over the open end of the casing **808** so that when the elongated sleeve is mounted on to the end of the casing **800**, the balloon is fixed there between. The casing **800** has a slot **808** extending along its length so that the balloon can be folded and partially disposed within the casing **800**.

The elongated sleeve **802**, at one end of the elongated casing **800**, as shown in FIG. **6**, is mounted onto the air pressure tube **708** so that an end of the elongated sleeve is disposed against the bottom end **704**F of the cylindrically shaped stem portion **704**C. The use of the elongated casing **800** having a slot **808** extending along its length, to facilitate the folding of at least a part of the balloon into the slot within the casing, is necessary so that the balloon **806** can be easily put into the bottle **702** when the volumetric displacement dispenser **700** is inserted in a bottle **702**. The slot **808** extending along the length of the elongated casing **800** allows the expandable balloon **806** to expand out into the interior of the bottle **702** when atmospheric air is drawn through the air pressure tube into the balloon, as described hereinafter.

The expandable operative balloon **806** (compare operative balloon **300**) is essential for application of any of the volumetric displacement dispenser device **700** of the present invention. As an operative element of the volumetric displacement dispenser device **700**, the expandable volumetric displacement operative balloon **806** is essential for the physical operation of the volumetric displacement dispenser device and performs the necessary operation for the volumetric displacement dispenser device to fill the void occasioned by removal of wine from the wine container **702**.

In operation, volumetric displacement dispenser **700** is placed into a bottle **702**. The ported stopper **702** is securely seated to provide an air tight and air-pressure tight seal within the neck of the bottle **50** and the cylindrical head portion **704**A is engageable over the mouth **702**A of the bottle neck **702**B.

The volumetric displacement dispenser **700** may be inserted into any vessel or container, irrespective of the configuration wherein evacuation of air or maintenance of an inert environment is desirable for the preservation of the fluids contained therein. In the preferred embodiment, ported stopper **702** may have an outer sealing ridge **704**D about the cylindrically shaped stem portion **704**C to engage the inner surface of the neck of the bottle **702** thereby forming a seal to prevent contaminants from entering the bottle.

The volumetric displacement dispenser **700**'s construction material can be selected from a group consisting of polymers, polymer alloys, non-ferrous metals, ferrous metals, carbon fiber, carbon powder, silicone polymers, elastomers, glass, ceramics and combinations thereof. The tubing **708** can be transparent to allow visual confirmation of the operation of the device. When indicated, use of the volumetric displacement dispenser **700** is for food or sanitary usage and compliance with U.S. Department of Agriculture (USDA) or U.S. Food and Drug Administration (FDA) regulations regarding the selected materials of construction is necessary. The volumetric displacement dispensers may be manufactured by any technique recognized in the Mechanical Arts which are capable of yielding a finished product satisfying regulatory guidelines governing the use of such products, i.e. FDA, USDA, etc.

In the embodiment shown in FIGS. **6-9**, upon pouring liquid (typically wine) from the bottle **702** (preferably a wine bottle), as shown in FIG. **6**, a suction force is applied to the surface of the volumetric displacement operative balloon **806** in contact with the liquid resulting in balloon inflation by drawing in atmospheric air through the air pressure tube **708**. To create the suction force, it is important to create an airtight closure of the ported stopper **704** so that the only air going into the bottle is going into the balloon **806** and the only liquid leaving the bottle is through pouring spout **712**. The negative suction force created by the liquid being poured from the bottle **702**, as shown in FIG. **6**, causes a volume of air to be drawn into the balloon **806** directly corresponding to the volume of liquid decanted. The balloon **806** floats on the liquid within the bottle and allows the liquid to flow through a path to the pouring spout **712**. When pouring the liquid, the opening of the air pressure tube **708** is preferably above the pouring spout **712** as shown in FIG. **6**. Note that the balloon **806** does not require to be slightly inflated before the atmospheric air will expand the balloon. This process is repeated by the user until the volume of liquid in the bottle **702** is decanted.

While the embodiments of the present invention disclosed herein are presently considered to be preferred, various

changes and modifications can be made without departing from the spirit and scope of the present invention. The scope of the present invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.

What is claimed is:

1. A volumetric displacement dispenser for dispensing liquid contents from an interior of a bottle with a bottle neck while preventing air from filling a void created within the interior of the bottle caused by the liquid contents being poured out of the bottle by gravity, the displacement dispenser comprising:

a stopper having first and second boreholes extending there through, the stopper being adapted to form an air-tight seal when it is seated into the bottle neck;

an air pressure tube routed through the first of the boreholes, the pressure tube having a first end and a second end and with the first end open to atmospheric air, and the second end open to and extending into the interior of the bottle;

an expandable volumetric displacement balloon attached to the second end of the air pressure tube;

a pouring spout in the second of the boreholes, said pouring spout having a one-way liquid valve disposed therein for preventing atmospheric air from entering the interior of the bottle through the second of the boreholes; and

further including an elongated casing disposed within the expandable balloon, the elongated casing being attached to the second end of the air pressure tube so that the expandable balloon can be inserted into the bottle when the stopper is seated into the bottle neck; and

wherein the elongated casing has a slot extending along its length to and into which the expandable balloon is tucked into the casing after being folded so that the balloon can expand out into the interior of the bottle when atmospheric air is drawn through the air pressure tube into the balloon.

2. The volumetric displacement dispenser of claim **1** wherein the air pressure tube is unobstructed to allow atmospheric air from outside the bottle to flow directly into the expandable volumetric displacement balloon.

3. The volumetric displacement dispenser of claim **1** the pouring spout is fitted within the second borehole has an opening there through forming a flow channel for pouring out the liquid from within the bottle and having the one-way liquid valve disposed therein.

4. The volumetric displacement dispenser of claim **3** wherein the pouring spout is connected to the outlet of the liquid one-way valve.

5. A method for dispensing liquid contents of a bottle with a bottle neck while preventing air from filling a void in the bottle caused by the removal of the liquid contents of the bottle, comprising the steps of:

seating a stopper having first and second tube boreholes extending there through into the bottle neck to form an airtight seal with the bottle neck;

routing an unobstructed air pressure tube through the first of the tube boreholes, the pressure tube having a first end open to atmospheric air, and a second end in communication with the open end of a volumetric displacement balloon disposed within the bottle;

dispensing the liquid from the bottle through the second borehole while atmospheric air is simultaneously drawn through the unobstructed air pressure tube directly into the volumetric displacement balloon whereby the displacement balloon expands and fills the void in the bottle corresponding to the volume of liquid dispensed from the bottle; and

encasing the expandable balloon within an elongated casing attached to the second end of the air pressure tube to enable the expandable balloon to be inserted through the bottle neck into the bottle.

6. The method of claim **5** further comprising the step of providing a liquid one-way valve in the second borehole to allow liquid within the bottle to pour flow out of the bottle via the liquid one-way valve while substantially preventing atmospheric air from entering the bottle through the second borehole.

7. The method of claim **5** further comprising the step of providing the elongated casing with a slot extending along its length into which the expandable balloon is tucked into the casing after being folded to allow the expandable balloon to expand out into the interior of the bottle when atmospheric air is drawn through the air pressure tube into the balloon.

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